Promoting the Production of Cashew, Shea, and Indigenous Fruits in West Africa

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Contents

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African agriculture at the crossroads*

Hans H. Bass

African agriculture is finally back in the spotlight of international development debate. The reason is not just the most recent famine. There are lasting problems which affect farming in Africa. In striking contrast to all other parts of the world, average output per acre has been stagnating in Africa for decades. Indeed, the continents' fast-growing population means that output per capita is actually falling. Inadequate facilities for storage and transport aggravate the problems, causing massive losses on the way "from field to fork".

It is often said that Africa still has vast areas that are fertile but unfarmed, so the use of high-yield seed, pesticides and synthetic fertiliser could trigger an African green revolution. If linked to new highways and served by upgraded ports, these land resources would turn into a real competitive advantage. African farmers would then not only tackle hunger in their own continent but could also contribute to satisfying world market demand for soy and cereals for the production of meat and agro-fuels.

An important element in this strategy are multinational companies and government funds from emerging economies, such as India and China, which are leasing large areas of arable land in Africa in anticipation of high world market prices. Adherents of the idea of a green revolution argue that these investors will also transfer the technology and expertise needed for an up-to-date agro-industry. African contract farmers would then be integrated into global supply chains and become familiar with modern information technology and up-to-date finance practices.

Pronounced proponents of this view include the McKinsey Global Institute, the OECD's Development Centre and the International Finance Corporation, the World Bank subsidiary that supports the private sector. Some African governments share this view. It is, however, based on a number of misconceptions.

Three misconceptions

The first misconception relates to the availability of land. Anyone familiar only with farming systems in Europe or North America is easily misled to thinking that much African land is not being used. In fact, such land may serve a great variety of different purposes that are not obvious at first glance. In mixed land use systems in semi-arid areas, for example, farmers normally leave arable land fallow for several years. The gathering of leaves and fruits from trees and shrubs and interlaced grazing cycles of nomadic herders complement the land use in a sustainable manner. Not land but water is the bottleneck-resource.

The under-use of vast open spaces in Africa is a myth. Many smallholder farmers in semi-arid areas have begun to reduce fallow seasons and keep nomads' livestock off their fields. Land conflicts are becoming more frequent. The poor soil quality of new plots is an important reason for low productivity.

Even in the forest regions, the appearance of lush African fertility is deceiving. Almost all nutrients are in the living biomass; infertile rock is close to the surface. Even if one disregards climate change, it would be impossible to use such land for intensive farming for long. Where intensive farming is possible, however, it is already being done, for instance in the Kenyan highlands or in densely populated Rwanda with its many small plots. The truth is that Africa does not have abundant vacant land.

* Article reproduced from People and the Planet, 18 April 2012

The second misconception is that an increase in food production will, by itself, overcome hunger. History teaches us that green revolutions mostly benefit large landowners. They are the ones who can recoup the investment in irrigation and machinery. Accordingly, land ownership becomes concentrated, and smallholders get displaced. When harvests fail, their yields are no longer suffice for survival, and since they have no other opportunities for generating income, they cannot purchase food either. The highways turn into open veins: Trucks take the harvests from the big farms to the cities, and the hungry stay behind – or flee to refugee camps and urban slums.

The third misconception concerns the net benefits of leasing land to international investors. In reality, the downsides outweigh the advantages. All too often, modern commercial farming renders traditional land use impossible. In Mali, for example, two huge areas are now used to produce rice for export to Libya and sugarcane for the national market. The irrigation channels have become insurmountable obstacles that cut across the routes of nomadic herders. Irrigation often also leads to the desiccation of soil within a wide radius. On the other hand, the new jobs for farm labourers are mostly seasonal and poorly paid. Management and professional tasks tend to stay in the hands of experts from the investors' home country, and seed and even agrochemicals are imported from Asia's emerging economies.

Whether an African economy really benefits from investments in large-scale irrigation is also moot. According to World Bank data, the costs of a conventional large-scale irrigation project are three times higher in Africa than in Asia. The reasons are the particularities of African soils and their fast salinisation due to evaporation. Only up-to-date irrigation technology, which requires much capital and maintenance, can bring the African project costs closer to the Asian benchmark. Capital, of course, is a crucial constraint in Africa.

Over the centuries, African farmers developed agriculture systems that meet the challenges of water shortage, barren soils, and extreme weather conditions. Their strategies to minimise risks and to mutually ensure security evolved over generations. Nomads' herds, for example, used to be a mixture of drought-resistant species and fast-reproducing ones. When farmers cleared fields, they tended to spare trees because they are relevant for medicinal substances, forage and articles of merchandise. Some farmers still optimise the use of major rivers' flood plains by planting and relocating various crops according to their specific water requirements.

Unfortunately, these sophisticated and appropriate land-use systems are under pressure today (see Box 1 below). It could make sense to base innovative approaches on them.

Box 1: Traditional systems under pressure

Many pastoralists are abandoning nomadic life and replacing it by sedentary animal husbandry. As the composition of herds is changing, they become more vulnerable to drought. It is also quite common that the animals are owned by city-dwellers as a sort of saving scheme. These people in particular want their herds to grow, but hardly invest in animal health. Growing herds, however, are a strain on the land. They are not sustainable in the long run. In the rural areas concerned, even the people are under threat, because animals and humans compete for the scarcest resource: water.

More and more trees are cut down for firewood or animal fodder. In semi-arid areas, irrigation puts trees in danger. Where water is pumped from deep wells, trees are prone to wither and die in a wide radius. Biodiversity is being eroded fast.

Monocultures of standardised crops are another problem. African eating habits are increasingly falling into line with international ones, so wheat, maize and rice are beginning to predominate. The snag is that African soil is not really suitable for these cereals. African farmers will never be able to compete with their American counterparts who grow them. Author: HB.

Better alternatives

Despite some historic examples of anthropogenic destruction of livelihoods by over- and misuse, African farmers in general understood their soils and the subtle interaction of crops and animals very well. This treasure is worth preserving.

What is needed is a green renaissance – not harking back to an alleged golden age, but reinterpreting traditional practices in the light of present-day conditions. Today, international agricultural research focuses on wheat and rice, but virtually ignores African plants. To date, the role the traditional crops could play is recognised only by a few research institutes in Switzerland, Taiwan and Germany, which are performing pioneering work in this field. The World Bank's Indigenous Knowledge Initiative is also worth mentioning.

The yields achieved by modern organic farming in the tropics can be as high as those of conventionally modernised agriculture. That was confirmed by various studies, including those conducted in Uganda and Tanzania by the UN Conference on Trade and Development (UNCTAD). Organic farming is of course more sustainable. It requires and contaminates less water, maintains soil fertility and does not depend on expensive inputs such as synthetic fertilisers and pesticides. The international community should recognise and reward such positive impacts in terms of environmental protection, and so should national governments. African countries' tax and subsidy policies tend to keep prices low in urban food markets. The idea is to prevent urban unrest. However, it would be much more important to tackle poverty in rural areas, where the need tends to be greatest and people tend to be driven into urban slums.

Food security needs to be at the heart of any support for the agricultural sector, whether it takes the form of advice for small farmers or funding for infrastructure. Food crops are more important than cash crops, rural roads are more important than highways, local and regional markets are more important than the world market. Neither poverty nor hunger will be eliminated by economic growth alone. These challenges need to be addressed directly.

Since animal husbandry must be environmentally sustainable, African herders have to understand that quality matters more than quantity. Veterinary services and compulsory vaccination programmes could contribute to raising awareness. The herders, however, are not the only ones that matter – so do city-dwellers who invest in herds. Unfortunately, sheer herd size is still widely regarded as an expression of wealth. It is crucial, therefore, to create more meaningful investment opportunities.

Finally, what is needed are small rural industries close to agriculture – especially in food processing. As the example of China shows, small rural industries boost regional productivity thanks to a better division of labour. They can – and must – generate income for landless families and reduce the pressure to migrate. Where produce is processed straight after harvest, losses are minimised, which in turn improves food security. In this respect, traditional methods of drying vegetables or fish are more important than sophisticated cold chain systems for the supply of urban supermarkets. Following a gradual improvement in quality and a niche specialisation, African producers could then also learn how to supply international markets. But the second step must not be taken before the first one.

Basic Facts on Cashew, Shea, and Fruits from West Africa

According to the United Nations Statistic Division, Western Africa comprises: Benin, Burkina Faso, Cape Verde, Côte d'Ivoire, The Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Saint Helena, Senegal, Sierra Leone and Togo.

The West African shea (karité) tree (*Vitellaria paradoxa*) grows naturally in the dry savannah belt. Grinding and cooking its fat-rich nuts allows the separation of oil from shea butter. Usage includes a wide variety of fields, such as nutrition, soap, and cosmetic and pharmaceutical skin care. Shea butter can also be a substitute for cocoa butter in chocolate. A targeted production of shea nuts is difficult: New plants often only randomly germinate and a tree's full yield capacity is only reached after approximately 50 years.

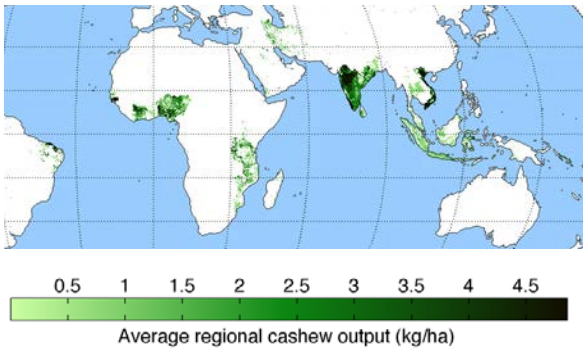
Map 1: Distribution of Shea nut tree (Vitellaria paradoxa)

Source: http://commons.wikimedia.org/wiki/User:Esculapio

Cashew trees (*Anacardium occidentale*) start to bear fruits only three years after planting and develop to full productive capacity after seven years. Cashew trees bear the nuts and the apple. Raw nuts have to be processed to edible kernels.

Technically this is a complex task due to the fact that the nutshell contains toxic oil (cardol), which has to be neutralized by way of roasting or water-damping. As cashew nutshell liquid (CNSL) is mostly composed of anacardic acids, processing cashew could provide scope for downstream industries, both pharmacological and cosmetic. The cashew apple ripens earlier than the nut and for this reason, along with its juicy pulp and fragile skin, it is unsuitable for transport. However, it can be processed to syrups, juice, or marmalades.

Map 2: Map of cashew production (2000)



Note: Average regional cashew output is computed as average percentage of land used for its production times average yield in each grid cell across the world. Map compiled by the University of Minnesota Institute on the Environment with data from Monfreda, C., N. Ramankutty, and J. A. Foley. 2008. Farming the planet: 2.

Untapped economic opportunities can still be found in the processing of plants growing exclusively or mainly in Western Africa, such as *Dacryodes edulis* (African Pear), *Irvingia Gabonensis* (African Mango), *Ziziphus mauritiana*, *Parkia biglobosa*, *Hibiscus sabdariffa,* Tamarind, *Saba senegalensis*, and *Detarium microcarpum,* along with tropical fruits which grow and are used in Western Africa as well as in other tropical and subtropical regions – such as mango, guava, and ginger.

Compile: Hans H. Bass

Cashew Technology

Simeon O. Jekayinfa

The cashew nut kernel is made up of three different portions—the shell, the kernel and the adhering testa. The primary product of cashew nuts is the kernel, which is the edible portion of the nut and is consumed in three ways: directly by the consumer, as roasted and salted nuts, and in confectionery and bakery products. Cashew processing is a tedious and arduous task because of the irregular shape of the cashew nut, the presence of tough outer shell and the corrosive cashew nut shell liquid (CNSL) within the shell.

Roasted cashew nut

Cashew nut requires a special kind of procedure in order to break open the hard shell and extract the nut. Cashew nuts are traded in a variety of different quality grades.

Cashew nut butter

To produce cashew nut butter, a batch of dried wholesome cashew nuts is steamed and then allowed to cool. Dried kernel is ground into very fine paste using laboratory mills, other ingredients like salt, emulsifier and hydrogenated palm oil are weighed and homogenously mixed with the cashew paste to produce cashew nut butter. The percentage of cashew kernel in the recipe may be varied based on individual taste.

Cashew Nut Shell Liquid

The cashew nut shell contains an extremely caustic, viscous and dark liquid, known as CNSL. It is contained in the thin honeycomb structure between the soft outer skin of the nut and the harder inner shell. The CNSL content of the raw nut varies between 20 and 25 per cent.

The CNSL is an important and versatile industrial raw material, having over 200 patents for its industrial application, in particular its use as raw material for phenolic resins and friction powder for the automotive industry (brake linings and clutch disks). Cashew resins are used as fillers in drum-brake lining compounds and may also be used as binders.

CNSL is also used in moldings, acid-resistant paints, foundry resins, varnishes, enamels and black lacquers for decorating vases, and as insecticide and fungicide. In tropical medicine, CNSL has been used in treating leprosy, elephantiasis, psoriasis, ringworm, warts and corns. It is also used for wood and fabric preservatives, paints, plastics, printing ink, and water-proofing compounds.

Other value-added products

The cashew kernel is very rich in fat (46 per cent) and protein (18 per cent) and a good source of calcium, phosphorus, and iron. The tart apple is a source of vitamin C, calcium and iron. The bark, leaves, gum and shell are all used in medicinal applications, to relieve toothache and sore gums, and the boiled water extract of the leaf or bark is used as a mouth wash. A paste of bark ground in water is used in topical applications for the cure of ringworm. The root has been used as a purgative.

Fibres from the leaves can be used to strengthen fishing lines and nets, and as folk remedies for calcium deficiency and intestinal colic, as well as a vitamin supplement. The water-

resistant wood is used for boats and ferries, while the resin, in addition to having industrial uses, is used as an expectorant, cough remedy and insect repellent.

Cashew apples

To date in West Africa less than 10 per cent of the cashew apple is consumed either as fresh fruit or in few cases processed into fruit drinks (Oduwole et al. 2001); the rest gets wasted – in spite of the fact that the apple is rich in ascorbic acid, thiamine, niacin and riboflavin and thrice as rich in vitamin C as sweet orange (Akinwale 1996). As cashew apples are harvested over a period of four months during the year, there is still a wide scope for value added products.

Cashew apples can be processed to a number of products (Ogunsina 2005; Suganya and Dharshini 2011):

- Cashew juice: Cashew apple contains 85 per cent juice, 10 per cent of which is sugar (Ohler 1979). Raw cashew apple juice is known to have some medicinal values: It is taken as a cure for stomach disorder and sore throat infections (Olunloyo 1996) as well as a brain stimulant because of the belief that it enhances human memory (Agnoloni and Giuliani 1977). Sound cashew apple can be used for juice extraction. The juice can be extracted with screw press, basket press or simple hand pressing; juice is strained through muslin cloth which is clarified by adding PVP (Polyvinylpyrrolidone) to remove the astringent properties of the cashew apple.
- Dried cashew fruit: Cashew fruit is boiled with salt for five minutes to remove astringent compounds before it is converted into a dried product.
- Cashew wine: To prepare cashew wine, cashew apples are cut into slices and are crushed in the juice press. The fruit juice is sterilized, filtered and treated to destroy or inhibit the growth of undesirable types of microorganism. After which the inoculum is added for fermentation. The stabilized and filtered wine is stored in a bottle. Cashew wine produced is a light yellow alcoholic drink, with an alcohol content of 6 to 12 per cent.
- Cashew apple jam: To prepare apple jam, Cashew apple is washed with water. The apple is immersed in three per cent salt solution for three days to reduce the tannin content, after which the fruits are steamed for 15 to 20 minutes at 0.7 to 1 kg steam pressure. Then the apples are crushed and mixed with sugar and boiled. A pinch of citric acid is added towards the end of the cooling process to improve the taste. Finally it is stored well in sterilized jam bottles.
- Cashew syrup: Similar procedures are followed for extraction of juice and removal of astringency as done in the pretreatment of juice. Sugar is added at the rate of 1 to 1.25 kg for every liter of juice. 20-25 g citric acid per liter and 0.08 per cent as sodium benzoate is added to the juice and thoroughly mixed for 4-5 hour and clear syrup is cooled and filled in bottles.

Using the cashew apple as a resource for a variety of processed products can substantially improve rural diets and also earnings on cashew for farmers.

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Production, processing, and marketing of cashew and shea from West Africa

Reuben Adeolu Alabi and Ojor Oshobugie Adams

West Africa is an important producer region for both cashew and karité. Today, West Africa contributes around one third to the world's total cashew production. Between 1990 and 2010, cashew production in West Africa increased 15-fold, while all-African production increased 10-fold, and global production 5-fold. With respect to karité, the West African region is the only production area in the world (apart from a negligible quantity being produced in Uganda), with production increasing by 25 per cent during the 1990 / 2010 period. In the case of karité, most of the increase comes from Nigeria, which today produces almost half of the world's total supply (all production data from FAOSTAT database). In spite of its unique position in the production of cashew and karité, West Africa is still far from reaping the full economic benefits of this situation as huge problems exist in production, processing, and marketing alike.

Productivity gaps in cultivation

Between 1990 and 2010, area productivity of cashew cultivation in West Africa increased from 0.38 tons / ha to 0.66 tons / ha in West Africa (+ 72 per cent), while global productivity increased from 0.41 tons / ha to 0.81 tons / ha (+ 94 per cent). The West African region as a whole is thus not only less successful than the world average in producing cashew, but it is even falling behind. However, there are huge differences within the region. In 2010, Nigeria had the highest yield of cashew nuts (1.8 tons / ha) in West Africa, while Benin had the lowest yield (0.3 tons / ha; all production data from FAOSTAT database).

Asogwa et al. (2008) attribute the increase in productivity of cashew production in Nigeria to price incentives. As cashew trees start to bear fruit after only three years and develop to full productive capacity after seven years, response to price incentives is potentially high. The propagation of a Brazilian cashew-cultivar by the Cocoa Research Institute of Nigeria (CRIN) contributed to the improvement of kernel quality and size and thus laid the foundation for increases in export prices (Hammed et al. 2007).

In the case of karité, the average West African yield decreased from 1.9 tons / ha to 1.4 tons / ha between 1990 and 2010. However, there are also huge differences in the region in this case: In 2010, Togo had the highest yield (4.4 tons / ha) and Nigeria had the lowest yield (1.0 tons / ha) (all production data from FAOSTAT database).

The decline of karité yields in individual production areas and in the region as a whole can be attributed to the fact that the karité trees are aging and have not been replaced by new ones. As new plants often only randomly germinate and a tree's full yield capacity is not reached until approximately 50 years later, the rejuvenation of karité producing areas calls for long-term strategies rather than short-term price incentives.

Technological problems in processing

Agricultural commodities are the second largest exports from West Africa to the EU (after petroleum oils and gas), yet most are exported with little value added locally. Large technological deficits are partly responsible for this fact.

Karité processing is mostly on a small-scale and artisanal, hence grossly inefficient, level (Kante et al. 2009). However, some progress is also possible in this stage of production. A Malian non-profit organization in cooperation with a US University has designed a mixer to knead shea paste, thus reducing the physical labor and time required to separate the solid from the oil. In addition, the Food Technology Laboratory (LTA) at the Institute of Rural Economics in Mali has developed improved karité-processing technology.

With respect to cashew processing, in West Africa only very few companies are involved. Instead, cashew nuts in shells are exported from West Africa to South and East Asia (India, Singapore, China, and Viet Nam) for processing, from where the kernels are exported to the USA and Western Europe (Aliyu and Hammed 2008). While in 2010 seven West African countries (Benin, Burkina Faso, Côte d'Ivoire, The Gambia, Ghana, Mali, and Nigeria) exported (including intra-West African transit trade) 570 million tons of unshelled cashew nuts (HS 080131) – i.e. roughly one third of the West African production – they exported only 21 million tons of shelled cashew nuts (HS 080132; all data from UN Comtrade database) – i.e. only about one per cent of the West African production. Larger processing plants exist in Nigeria, Ghana, and Côte d'Ivoire. While the Nigerian relation of processed to unprocessed exported nuts is 20 : 100, the relation in all other West African countries was well below 5 : 100 – with most countries exporting shelled cashew nuts only on a development-aid based and artisanal level, including such frameworks as fair-trade schemes.

This indicates that there is substantial potential to allocate larger parts of the value chain to the West African region – provided there are first inflows of capital and technology and, secondly, cashew production is large enough to supply processing units with enough input to operate above the minimum efficient scale. Both preconditions already exist to a certain degree in Nigeria, where cashew cultivation has not only increased substantially due to price incentives but Nigerian operators also have joint venture partnerships with Indian enterprises.

Constraints in international marketing

Karité is mainly consumed in West Africa; a mere five per cent of an annual harvest is sold overseas. The main industrial consumption of shea butter outside Africa is in Europe. Recent changes in EC regulations on the use of substitutes for cocoa butter have increased demand for shea butter from chocolate confectioners, as it is now possible to blend up to 5 per cent non-cocoa butter equivalents into chocolate products. Furthermore, the economic recovery in Russia and other successor states of the former Soviet Union has led to an increased demand for shea as an ingredient for their confectionery products.

Shea butter produced on the artisanal level is a major ingredient for cosmetics in West Africa. However, there have also been some attempts to market local cosmetics products produced in semi-industrialized processes. The Ghanaian Lever Brothers' experience of producing a mass-market skin moisturizer product containing shea butter indicates the potential of regional cosmetics markets, especially with a growing middle class in some West African cities. There is also a renewed and increasing interest in shea butter from the international cosmetics industry, such as Body Shop.

Nevertheless, many marketing opportunities remain untapped. Major limitations to the international marketing of karité result from insufficiencies with regard to quality standards. The same holds true for cashew nuts. Quality standards for cashew nuts include regulations such as moisture content below 8.5 per cent, a total of defective nuts and other impurities below 5 per cent of the weight, and the nuts being free from extraneous matter, insect damage

and immature nuts (FMCI 2007) – all of which are often not met by West African producers. A further constraint lies in the fact that cashew and karité from West Africa are not homogenously composed, which impedes standardized processing (USAID 2001).

Given, the different qualities both in unprocessed and processed cashew nuts, export earnings differ tremendously within West Africa. In 2010, the export value of a ton of unprocessed cashew nuts ranged between US$ 158 for nuts from The Gambia and US$ 1.665 for nuts from Nigeria. An even larger range could be observed for processed nuts: A ton of processed cashew nuts exported from Nigeria could be sold on average for US$ 4.248, while a ton exported from Mali was sold at only US$ 305 (data computed from UN Comtrade database).

Conclusion and recommendations

Productivity improvements can result from developing and adopting improved cultivars. The Nigerian efforts have successfully targeted the production of larger cashew nut sizes, which achieve higher sales prices on the international market. Such efforts should be sustained. In addition, augmentation in inputs to fertilize and protect plants should not be neglected. Finally, extension is vital to ensure that farmers plant the most high yielding cashew trees and treat them in an appropriate manner.

Deficits in processing are one of the main reasons for the low quality and quantity of exports of cashew and karité. They may be overcome by inflows of foreign capital and technology, as the Nigerian example indicates. Only if quality standards are met, will exports be possible at all.

The implementation of certification and standardization processes and quality improvements, however, would allow processors to penetrate not only the regional markets but even international markets for quality kernels.

Finally, the lack of an organized approach to the international market is another constraint that prevents the West African region from realizing its potential comparative advantage in the production and processing of nuts. Active participation of private agencies in the marketing process can be the answer but governments and development agencies could also become involved.

All in all it is important to view the value chain from tree to shelf as a whole and to provide not only knowledge, access to credit, and access to technology at various stages but also chain coordination and to improve the business environment in general.

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The cashew sector in Ghana

Klaus von Freyhold

Ghana is among today's most successful African countries – even if macroeconomic stability has not yet been fully achieved, as can be seen for instance from its relatively high inflation rates. In 2011, Ghana attained lower middle-income status in the World Bank's classification. In comparison to other countries in the region, the political system of Ghana is stable, governance is relatively efficient and the business climate is conducive to economic growth. In terms of corruption, for instance, Ghana ranks 64th out of 176 countries in Transparency International's 2012 Corruption Perception Index (TI 2013) and in terms of business climate Ghana ranks 64th out of 185 countries in the World Bank's Doing Business Index (WB 2013) – in both respects Ghana is by far the best performing country in West Africa.

However, poverty is still widespread in Ghana. In the northern savannah regions nearly 60 per cent of the population live below the national poverty line, while the southern parts are much better off (20 cent poverty) (WB 2012). Even if accelerated growth will on average allow Ghana to meet its millennium development goals, the poverty rate in the North will remain high in the years to come. By 2015, more than two thirds of the country's poor will live in the North, compared to 45% in 2009 (ECOWAS Commission 2009). An important strategy to overcome poverty by accelerating economic growth in the North would be to pay greater attention to the development of non-traditional cash crops – such as cashew.

Cashew production in Ghana is characterised by a large smallholder sector with average farm sizes of below 2.5 ha and a very small commercial farm sector (ACi 2010 a). A substantial part of agricultural land that is unused and underutilized for crop production is found in the savannah agro-ecology zone in the northern part of the country. Here, average annual rainfall is about 1,100 mm which is regarded as sufficient for cashew production. With their extremely deep roots, cashew trees are fairly resistant to drought in addition to being capable of withstanding temperatures as high as 40°C. This feature of the cashew tree makes it an ideal cash crop for the northern parts of the country where cash crops like cocoa cannot be grown. Many poor farmers could benefit from the additional income to be derived from the sale of cashew tree products.

Present structure of the cashew value chain and plans for improvement

Production

In Ghana, average cashew yields with improved agronomic practices range between 500 and 600 kg per ha (FAO data 2012), whereas traditionally managed cashew production by small-scale farmers can be considerably lower (GAIN 2012 a). Potentially, cashew yields could reach more than 3,000 kg per ha (such as in Vietnam; FAO data 2012).

In September 2010 the Minister of Food and Agriculture declared that Ghana plans to double yield per hectare and to triple production within ten years. This statement seems to underline the commitment of the government to focus on a cash crop too long neglected. Instrumental in achieving this goal should be the use of improved agronomic practices, improved planting material as well as farmer training programs (MOFA 2010). Improved planting material is so far available in three regions from 20+ nurse-

ries, either privately owned or managed by farmers' organisations (ACi 2010 a).

In recent years, local cashew nut production has increased from 30,000 metric tons in 2010 to 35,700 tons in 2011 (FAOSTAT estimates) and to 49,000 tons in 2012 (GAIN 2012).

Domestic trade

Trade in raw nuts occurs between February and May with little structured organization. Since this is an activity restricted to only four months of the year, there are no farmers' associations or unions nor private traders exclusively trading in cashew. Presently there are 13 companies buying raw cashew nuts almost exclusively for export, nine of these are local companies, and four are foreign, mainly Indian. Various types of middlemen are engaged in the marketing of raw nuts in a rather haphazard fashion. Often they are seen as reducing the margins for cashew farmers. In actual fact, however, the range of small traders does not exist because of the attractiveness of the margins that they make but because of the difficult infrastructure and the lack of local financial services (ACi 2011). In contrast to the still highly regulated cocoa industry, there is no particular regulative environment in Ghana's cashew trade.

Processing

In 2010 there were about twelve processing plants for raw cashew nuts in Ghana (ACi 2010) equipped to process raw nuts into plain kernels mainly for export. Processed exports were 1,500 tons (UN Comtrade data). Only very small quantities of the plain kernels were and are further processed for local consumption by around 20 kernel roasting companies (ACi 2010).

In recent years, Ghanaian processing firms such as Ghana Nuts Ltd. in Techiman and the Muskaan Group's processing facility in Nsawkaw (both in the central Brong Ahafo Region) increased their production. Ghana Nuts Ltd. is in fact one of Africa's first fully mechanised processing plant for drying, roasting and shelling raw cashew nuts and for kernel grading. According to UN-Comtrade data, in 2011, Ghana was already able to export 26,000 tons of shelled cashew nuts (plain kernels).

International trade

As a result of both increased production in Ghana and particularly increased imports from neighbouring countries, Ghanaian exports of raw nuts skyrocketed to 132,000 tons in 2011 (UN Comtrade data). About 100,000 tons can be estimated to be re-exports. Raw cashew nuts were imported to Ghana for two reasons. First, the civil unrest in Côte d'Ivoire curtailed the safe transportation of raw cashew nuts from the north of the country to the port of Abidjan. The middlemen in Côte d'Ivoire's northern growing areas were thus forced to smuggle their cashew nut purchases across the border to Ghana where they received a better price on account of comparatively lower transport costs to Tema harbour instead of Abidjan. Second, the rising demand for raw cashew nuts by Ghanaian processing firms provided incentives to transport nuts to Ghana.

Meanwhile the Ivorian political situation has stabilized with serious repercussions for the Ghanaian cashew industry. Xinhua News agency reported on 16th April 2012 that the Côte d'Ivoire government had decided to vigorously combat the illegal exportation of cashew nuts to the neighbouring countries, especially Ghana. Since then illegal cross-border trading has already fallen from its peak in 2011 to 100,000 MT of RCN in 2012. Illegal cross-border trading from Côte d'Ivoire should in actual fact be even less since the above figure includes legal transportation of RCN from Burkina Faso to Tema harbour for transhipment.

Until 2010, nearly all the Ghanaian cashew production was exported unprocessed, mainly to India (68 per cent). Since then, the processed-to-unprocessed ratio in exports has changed

dramatically. While in 2010 processed kernels represented an equivalent of five per cent of the weight being exported unprocessed, this figure rose to 20 per cent in 2011.

According to government plans, the amount of cashew nuts that are processed domestically is to increase to 30 per cent of the total crop (MOFA 2010). The Ghana Investment Promotion Council places cashew tenth in Ghana's cash crop promotion priorities (GIPC 2011).

Promotional activity

In recent years, Ghana's cashew industry has been promoted by a number of development projects, including the following:

- The *Cashew Development Project (CDP)* was financed between 2002 and 2010 by the African Development Bank. Components included production development, extension and training, credit, as well as project management and technical assistance. However, this project considerably underperformed against the set targets in the appraisal report of 2000. For instance, instead of the 18,000 ha to be put under cashew plantation it achieved only 1,465 ha (MOFA 2010).
- *ADRA Ghana's development interventions*, supported by ten donors, aimed to promote non-traditional high value crops including cashew. It operated from 2002 to 2007 (ADRA 2007).
- The *Trade and Investment Program for a Competitive Export Economy (TIPCEE)* was funded by USAID between 2005 and 2009. Its Export Business Development (EBD) component promoted high-value export crops such as cashew, targeting it for the international market. At the industry level, TIPCEE – working with Ghana Standards Board (GSB) and industry associations – concentrated on the adoption of industry norms. Collaboration was established with the *West Africa Trade Hub* to coordinate cashew marketing activities and access to new markets.
- The *African Cashew Alliance (ACA)*, founded in 2005 with USAID-finance, and headquartered in Accra, Ghana, was established to provide advocacy.
- The *African Cashew Initiative (ACi)* was founded with the help of European and American funds and is headquartered in Accra. It is designed to improve the productivity of the whole cashew value chain from raw cashew nut cultivation via processing and international marketing. The project duration is scheduled to last until March 2019.
- The *EXPECT Initiative* is funded by the Economic Community of West African States (ECOWAS) and was launched in 2010. It aims to support SMEs in potential lead value chains, including cashew.

In addition, there are a number of national advocacy organisations for the cashew industry, including the *Association of Cashew Processors of Ghana (ACPG)* and the *Cashew Producers and Exporters Association of Ghana (CAPEAG).*

Problems

In spite of some achievements, the Ghanaian cashew industry is still confronted with a number of impediments along the value chain. The twelve most important issues are listed below.

(1) There is a bias in government sector policies against agriculture (with the exception of cocoa production). Government attention is rather focussed on sectors such as the tourism industry and the emerging oil industry (B&F Times, 09-05-2012). Policy guidelines for the cashew industry, such as a "cashew act" comparable to the "cocoa act", do not exist at all. On all government levels there is far too little awareness of the potential of the cashew nut industry and especially of the benefits of the local processing of cashew nuts in terms of employment generation and value creation. It is also not sufficiently taken into account that processing jobs could provide income opportunities especially for women in rural communities (ACi 2010).

(2) As domestic savings rates are very low, Ghana is highly dependent on the inflow of foreign capital either in the form of foreign direct investment or as transfers in the form of development aid (Bhasin and Obeng 2007). However, foreign investment in agriculture is extremely low in comparison to other sectors. In the first quarter of 2012, FDI in agriculture was below 1 per cent of the total inflow (GIPC 2012).

In addition, development aid transfers, which account for 11.7 per cent of GDP, also show various biases (Herfkens and Mandeep 2008). First, as a result of the substantial out-migration of Ghanaian university graduates ("brain drain"), salaries of foreign experts constitute a substantial part of technical-aid transfers at the expense of capital transfers. Secondly, the southern regions of Ghana are privileged vis-à-vis the northern regions as recipients of foreign aid.

(3) Land rights are not clearly defined and overlapping systems of customary and modern law (Throup 2011) may prevent farmers from investing in technical improvements and entrepreneurs from setting up processing plants. Especially immigrant farmers are affected by insecure land use rights on their farms. Due to lack of proper collateral, local banks are very reluctant to provide credit to farmers. Thus, there is obviously a need to accelerate the formulation and enactment of a modern land policy that facilitates cashew production and in-country processing.

(4) Another important impediment to primary production lies in the fact that the preparation of fields and cashew nut collection fall in the same season, i.e. between March and May. Normally, the first priority of farmers is food security. However, as cash receipts for raw nuts come before food crop harvests, farmers are often prepared to forego labour in food production for cashew collection. Their aim is to purchase foodstuff as early as possible on account of end-of-the-dry-season depletion of farm stores. In addition, there are conflicts between herdsmen who start bushfires to allow grassland recovery, and farmers whose trees are affected by this practice. For the producers, the volatility and the unpredictability of prices complicate decision making: Prices change annually and seasonally and reflect influences from the world market dynamics, including the exchange rate of the Ghanaian Cedi to the US Dollar (ACA 2010).

(5) Research in cashew production is widely neglected. Carried out under the auspices of the Cocoa Research Institute of Ghana (CRIG), it seems to be treated as a minor activity only. There are two research sub-stations located at Bole and Wenchi in the northern savannah zone where some emphasis is laid on shea nut and cashew research activities. Development of appropriate planting material and research on the improvement of agronomic practices for cashew production is by far not given the consideration required for sector productivity advancement and maximum returns to farmers. Research has to be considered as a priority, as the quality of nuts at farm gates largely influences prices (Sarpong 2011).

(6) Despite the announcement of a new agricultural extension policy in 2003, Government agricultural extension delivery is still constrained by a number of factors. These include understaffing and the still slow or ineffective diffusion of technology. This results in a still too high incidence of pests and diseases, in too little irrigation to overcome poor rainfall distribution, and in inadequate marketing and processing facilities.

(7) It is estimated that 60 per cent of Ghanaian farmers are women (CARE 2004-9). Little attention, however, is paid to on-farm trials focussing on the specific production problems of women in relation to the requirements of agricultural production. Gender inequality in the agriculture sector has undermined the achievements of sustainable agricultural development because

programmes and projects are not systematically formulated around different needs, interests, roles, responsibilities, status and influence in society of women and men. Dissemination of new and improved technologies through extension services is highly unbalanced between women and men farmers, with as little as 20 per cent of services reaching women while they are the ones who could be instrumental in increasing cashew production on small farms (FASDEP 2007).

(8) Transportation of cashews involves various stages: from the farms to the various types of purchasing centres and processing plants and from there to the harbours for export or to retailers for local consumption. The Ghanaian road network is of too low density and all-weather usage is not secured in rural areas. Ghana achieves a very low score of 20 per cent for her road network on the M&A maturity index (Ernst & Young 2012). The poor score is especially detrimental for cashew production in the northern parts of the country. The additional cost against the benchmark value amounts to 50 per cent (USAID 2009). In addition, cheap water transportation of bulk agricultural produce, including cashew, from the North to the South hardly exists – despite the fact that Lake Volta with its south-northward direction provides 1,125 kilometres of arterial and feeder waterways.

(9) Substantially higher value adding can only be achieved if processors are equipped with sufficient organizational, managerial, and technological skills to directly produce for the international consumer markets in the US and in Europe. Product quality has long been an issue in the promotion of cashew production but its importance has been magnified in recent years because of the focus on food safety and traceability. There is an absence of inspection companies in the industry and agents and exporters are frustrated by the lack of clear guidelines to vouch for the quality of raw cashew nuts traded. The African Cashew Alliance aims to change the situation by endeavouring to introduce the ACA Quality and Sustainability Seal as an industry-supported label signalling compliance with international food safety, quality and safety standards.

(10) Regarding the local market for final products, competition is fierce, because imported roasted kernels are often cheaper than domestically produced ones, as processors in India and Vietnam benefit from lower electricity costs, lower unit labour costs, and stronger government support of cashew production and processing.

(11) The country's currency policy is a mixed blessing for the cashew industry. The Ghanaian currency has experienced a rather strong depreciation. In the first two years after the introduction of the New Ghanaian Cedi (GHS) on July 1st 2007, it lost 38 per cent against the USD. At the end of 2012 its external value against the USD was 50 per cent lower than at its introduction (OANDA data). This development helps the raw material exporters. It has, however, an adverse effect on the import of processing devices, such as shelling machines, cashew boilers and dryers (mainly imported from India).

(12) The Ghanaian cashew industry also suffers from impediments which can be generally felt in the Ghanaian economy. Potential foreign investors may be reluctant to invest because of the high risk of default of commercial partners. In addition, excessive centralization and corruption also makes business cumbersome. A further challenge is the risk that, as can be seen in other African countries, the beginning of oil production in Ghana could lead to a loss of competitiveness of the agricultural sector, despite the fact that agriculture remains the primary livelihood for the majority of the population, especially the poorest people (WB 2011). Also, social pressures are building due to the slow growth of the country's agriculture sector

and its inability to provide jobs for Ghana's growing labour force.

Proposals

On the international market the Ghanaian cashew industry can only compete if it substantially improves its productivity along the value chain – from farm level to transhipment of its produce. The industry needs to aim at quality output. It will have to improve the presently weak distribution system for all types of farm inputs, including high-yielding planting material, extension and training in better agronomic practices, especially for reducing the presently high incidence of pest infestations, streamlining of raw nut purchasing for farmers to receive higher farm gate prices, to improve processing procedures and to lower the unit labour costs. The government would be well advised to enact a "cashew act" similar to the "cocoa act", to formulate an accepted land policy, to improve the rural feeder road system and to improve the effectiveness of the national transport system.

In 2008 the OECD (Herfkens and Mandeep) stated that multi-donor approaches to development programmes like cashew development would be a better solution than dividing them amongst individual donor governments and NGO donors. In general, donor assistance should focus on promotional campaigns for Ghanaian cashew nuts in advanced countries so as to create a ready market.

Ghana is endowed with huge potential for the production and processing of cashew for the local and overseas markets. A determined cashew development policy could especially boost direct and indirect income opportunities in the northern parts of the country, thereby assisting in correcting the imbalance in the socio-economic conditions between the North and the South. So far cashew development is mainly left to donors. A convincing local drive would be required for the establishment and management of an organized and sustainable cashew industry to give sufficient and necessary support to the peasant farmer.

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Assessing the potentials of processing nuts and fruits in Mali

Hans H. Bass

Mali is one of the world's largest producers of shea nuts. Cashew trees also grow in Mali, but they are less important here than in other West African countries. Furthermore, a huge number of indigenous plants offer processing and marketing opportunities still waiting to be realized.

Mali's shea nut production

In 2010, Mali's production of shea nuts was 200 tmt, 29 per cent of the world's production, second only to Nigeria (46 per cent; FAOSTAT database). Estimates are that Mali presently makes use of only two thirds of its production potential (LTA / IER 2005, p. 25). Also, Mali exported only 4, 000 tons of shea nuts in addition to 5,000 tons of shea butter in 2003 – i.e. only 3 per cent of total African exports (UN Comtrade database).

Collecting and processing nuts provides seasonal employment and cash income for about three million Malian women (traditionally men do not engage in the shea nut business). The main constraints for an increased collection are that, as the shea trees are widespread in the area, collection is only small-scale, in a radius of a few kilometers around a village, and that shea nut collection competes with other work obligations for women during the rainy season (June to September).

Transformation of shea nuts to shea butter is usually organized by groups of women. In addition, there are three industrial enterprises processing karité nuts in Mali. However, all three enterprises have always been far below their production capacity, due to both the insufficient quantity and quality of the raw material (LTA / IER 2005, p. 25).

Furthermore, in household-based processing the constraints are the unpredictability of product quality, a low-level processing technology, an excessively long chain from producer to market (i. e. the inclusion of various levels of intermediaries) and a lack of market information (MEIC / DNCC b). Constraints on the domestic consumer side can be seen in the fact that imported substitute products are cheaper and have a higher prestige, reflecting the lack of consumer awareness of the nutritional value and the therapeutic attributes of shea.

In the past, various development projects aimed at increasing quality and quantity of shea butter production in Mali by introducing mechanical presses to small-scale production units However, these efforts were largely unsuccessful, mainly due to the arduousness of the work involved for the women (LTA / IER 2005, p. 25). More recently, a number of initiatives, such as an UNIDO food processing pilot center, have targeted the international marketability of Malian shea butter (UNIDO 2007).

Given the fact that the shea tree's occurrence is limited to Africa alone, shea provides a unique competitive advantage for Mali. It should be pointed out, however, that due to the botanical specifics, the potential of shea processing is limited and cannot be extended in the short to medium term.

Mali's cashew production

In Mali, cashew trees are planted in a number of districts around Sikasso and Bougouni, along Côte d'Ivoire and southern Burkina borders; a secondary production area based on old trees is located around Koulikoro.

Besides labor and land, few inputs are used, occasionally some insecticides (ACA 2007). Approximately 12,000 small-sized farms produce an average of 3,500 tons of raw cashew nuts per year (MEIC / DNCC a) along with some 120,000 tons of cashew apples (FAOSTAT data).

Being harvested from February to April, working-time allocation to cashews does not compete with main crops. The trees also help to stabilize results from other crops, as their tolerance against occasional droughts makes them instrumental in reducing soil erosion. For many farmers, cashew nuts are the only source of cash income. However, with 3.2 tons per hectare, cashew nut yields in Mali are only 50 per cent of the West African average and only 40 per cent of the global average (computed with FAOSTAT data).

With the exception of a few micro-operators located in Bamako with a total production capacity of less than 0.1 per cent of the harvest and producing for retail in Bamako (ACA 2007), almost all nuts are exported to India for final processing (UNCTAD 2007). The present Malian production of raw cashew – less than 1 per cent of the West African total – seems to be too small to meet the minimum efficient scale necessary to process cashew nuts in standard qualities for demanding international markets.

The alternatives are either to exploit economies of scale by cross-border cooperation (with northern Côte d'Ivoire) or to produce only for the premium segment of the final consumer market and applying a suitable processing technique for this target market, such as the newly developed, labor-intensive Indonesian cold state cashew shell-opening (Kovacsics 2006; Rütter et al. 2009).

Also, the international marketing of organically grown cashew kernels could be facilitated by the fact that chemical inputs to production are currently low, even if the present low quality of the bulk of the nuts from Mali constitutes an impediment to this option which cannot be overlooked (MEIC / DNCC a). Finally, cashew apples still have a largely untapped potential for being processed to durable products, both for domestic consumption and for exports.

Processing fruits in Mali

Fruit and vegetable processing in Mali includes desiccation as well as transformation into juices, syrups, and preserves. Production units in fruit and vegetable processing are mostly family-based and informal. Traditional open-air desiccation includes onion and shallot, tomato, pepper, and gombo (*Abelmoschus esculentus*). More advanced techniques of shallot desiccation established under the impact of development projects (Dogon plateau and Office du Niger area) reduce damages from impurities and vermin. The practice of mango and vegetable leaf desiccation has only recently been introduced in the Sikasso and Koulikoro regions. Various women's groups are involved in the desiccation of mango (LTA/IER 2005; see Box 2).

Box 2: Case Study "Dried mango business"

Mme. Diahara Kamissoko Traoré, entrepreneur and president of a cooperative of six female entrepreneurs, started to produce dried mangoes in 2005. With the support from the Swiss Development Assistance (Helvetas) entrepreneurs bought gas driers and received training courses in hygiene, production, and management. Starting with a production of just 380 kg of dried mangoes in the first year, she increased production 20-fold within two years, aiming to serve local consumers in off-harvesting season, and also export markets in the long run. Apart from expanding in the mango business, diversification into the production of dried fruits is also a goal to make use of drying capacities outside of the mango harvesting period. Difficulties for the business are seen on the cost side (gas being more expensive than in Burkina Faso, where there are subsidies) as well as on the output side (due to lack of packing and exporting enterprises). Plastic bags for packing are imported from the Netherlands.

Source: Inauen, C. (2007), Trockene Früchte, saftige Preise, in Helvetas Partnerschaft, August, pp. 9-11. Author: HB.

In Mali, *Ziziphus mauritiana* (jujube) is processed to snack foods. *Parkia biglobosa* (néré) seeds are processed by boiling, cleaning, and fermenting to the popular condiment *soumbala* (Anonymous 1993). Yet, as néré seeds have become short in supply, substitutes include *soumbala* made from other kinds of seeds, such as soybeans, as well as imported or Mali-made bouillon cubes ("Maggi"), which, however, lack the proteins and essential minerals of néré-based *soumbala*. The processing of néré is considered to be highly profitable, but access to peeling machinery is a bottleneck (LTA / IER 2005, p. 28).

Juices, syrups, and preserves are produced with mango, *Hibiscus sabdariffa* (dah rouge), ginger, and tamarind as the main ingredients. Furthermore, *Saba senegalensis* (zaban), guava, and *Detarium microcarpum* (tabacoumba) are processed, albeit on a much smaller scale. The small transformation units mostly lack the production and quality-control equipment necessary for the extension of production quantities and for a constant high quality. Only a few enterprises of the Malian food processing industry can be considered as producing near or at industry-level. They are reported to produce soft drinks only on the base of *imported* fruits and aromatic extracts.

For the majority of the Malians these processed products are still considered to be luxury goods (LTA / IER 2005, p. 18) and the local market is thus very limited. Furthermore, processed fruits and vegetables have not been exported in any relevant amount. Here, food safety standards are a major constraint. Recently, however, one Malian enterprise started to produce mango preserves in larger quantities and close to international quality standards.

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Promoting agriculture, agro-industry and agribusiness in Africa. The role of science, technology and innovation (STI)

Karl Wohlmuth

Africa has three economic problems: stagnation of agriculture, de-industrialization of its manufacturing base, and marginalization in trade, especially for manufactured goods. With new strategies – to make agriculture more dynamic and to develop agro-industries and agribusiness – these three problems can be overcome. Science, technology and innovation (STI) policies, STI infrastructure and capacity building at the level of human resources play an outstanding role in this respect. Three action levels have to be analyzed where STI inputs feature as important factors – the sub-sectors, the value chains and the export products/firms.

Action level one: Creating linkages between agriculture, agro-industry and the STI infrastructure

Linkages have to be strengthened between agriculture and various related sectors: industries supplying inputs to agriculture, such as machinery, equipment, irrigation systems, fertilizers, and seed products. Linkages are also significant between agriculture and processing industries, such as food and beverages, tobacco products, paper and wood products, textiles and apparel, shoes and leather products, rubber products, and agro-based building materials. Linkages are also vital between these processing industries and the production of machinery and equipment for these industries.

Last but not least, various service industries are needed for agriculture, input industries for agriculture, processing industries and input industries for processing industries, such as trade, transport, marketing, insurance, packaging, design, information and communication technology (ICT) services, business services and technological services. All this amounts to agribusiness activity related to agriculture. This is a productive system and is bound together by the flow of material and knowledge, as well as information and innovation.

So far, the importance of the supporting industries for agricultural development is extremely low in Sub-Saharan Africa. The share of the agribusiness value added to the agriculture value added is minimal: one dollar value added of agricultural production is supported by an agribusiness value added of only 50 cents, while in the USA the relation is 1 dollar for agricultural production to 13 dollars for agribusiness (UNIDO 2011; Yumkella et al., eds., 2011, p. 27). Linkages between the sub-sectors can be promoted by industrial policy, selective trade protection, subsidies, private enterprise development, infrastructure development, market development, and especially by the promotion of research and development (R&D) and technology development.

Seven development pillars were investigated by a recent UNIDO project to support the linkages in agribusiness and to increase the productivity of agribusiness (Yumkella et al., eds., 2011; UNIDO 2011). It is possible to develop a new policy framework on the basis of these development pillars for creating such linkages, although the country case studies in the framework of this project illustrate how weak these linkages are in most of Sub-Saharan Africa at present (UNIDO 2011).

As one of the seven development pillars, STI is of great relevance for linking these subsectors

of agribusiness with efforts in the area of technological capacity building and human skills creation (Wohlmuth 2011).

STI inputs are required in all agribusiness subsectors as the example of Rwanda clearly shows (Watkins and Verma, eds., 2008). Rwanda has proven that it is possible even for a low developed African country to build the human capacities and to develop the STI infrastructure needed for agribusiness development. Agriculture, agro-industry and agribusiness are systematically linked to local capacities for R&D, to extension, education and training programs, and to business, industry and technology development institutions. A holistic human capacity building and industry development strategy was developed (see Box 3).

Box 3: Developing Rwanda's National Innovation System (NIS) in the context of agribusiness development: A benchmark case.

There are five major components of Rwanda's science, technology and innovation (STI)-based structural transformation exercise: food industry; high value added exports; development and diffusion of appropriate technologies; delivery of clean drinking water and development of geothermal energy; and client-focused agricultural research and outreach.

Starting from a situational analysis of Rwanda's food industry and Rwanda's value added export sector, the key constraints in terms of human capacities and STI infrastructure were identified. Based on the existing linkages between agriculture and agro-industry, the potential role of STI infrastructure and of human skills capacity was investigated. Restructuring the (traditional and modern / informal and formal) food industry for the domestic market and promoting the production of high value added cash crops for exports are based on a comprehensive STI strategy.

For the food industry the existing opportunities for the upgrading of informal processors of traditional products, like banana wine, sorghum beer, meat, fruit juices, cereal and cassava flour, and bread, were identified.

The opportunities for import substitution were also identified, e.g.: in fruit pulps and juices, dairy products, and meat products; the focus being on both the domestic market and the regional market of the East African Community (EAC).

Furthermore, the opportunities for high value added exports were identified, not only of high-quality specialty coffees but even of new products like fruit juices, dried fruit, and honey. All this is done on the basis of an integrated STI and human skills development strategy (Watkins and Verma, eds., 2008).

In this process, Rwanda is systematically developing its so far rudimentary National Innovation System (NIS) in the context of agribusiness development by linking farms and firms, first to R&D infrastructure, to extension, training and education institutions; second to innovation finance institutions; third to intellectual property agencies and technology and business support systems; and fourth to public regulatory agencies, such as for registration, licensing, environmental protection, and for information and communication technology (ICT) regulation, competition regulation, property protection, and land use administration (Wohlmuth 2011). All these institutions / players link up to the NIS of a country, economy-wide and sector-wide, such as for agriculture.

Beyond this, industry and business associations and knowledge and extension institutions are brought into partnership with public regulatory and administrative agencies. Thereby, a dialogue between public and private players/sectors is emerging; there is evidence of growth-enhancing effects from this form of cooperation.

Sources: Watkins, A. and A. Verma (eds., 2008), Building science, technology, and innovation capacity in Rwanda, Developing practical solutions to practical problems, Washington D. C.: IBRD / The World Bank; Wohlmuth, K. (2011), Strengthening technological effort and innovation capabilities, in: K. K. Yumkella et al. (eds., 2011), Agribusiness for Africa's prosperity, Vienna: UNIDO, pp. 165-199; Author: KW.

Action level two: Integrating STI capacities into agro-industrial value chains

At the level of agribusiness value chains, science, technology and innovation (STI) components play an increasingly significant role in Africa but much more has to be done by government and private business to stimulate innovation capacity. Case studies indicate a rather high endogenous innovation potential of agribusiness value chains (see Larsen, Kim and Theus, eds., 2009).

When comparing country experiences of selected agribusiness value chains, it emerges that innovation takes place rather unevenly at different levels/ranks of the chain and differently at country level (Larsen, Kim and Theus, eds., 2009): this can be observed for Ghana (cassava, cocoa, and poultry), for Kenya (maize, tomato, dairy), for Tanzania (sunflower, cassava, dairy), and for Uganda (fish, bananas, vegetables). To spread the innovation potential along the value chains and for all countries, Rwanda-type governmental policies towards STI can be recommended.

Another study (Ponte 2011) compares the value chain upgrading strategies (in terms of new products, new processes, new functions, etc.) for fresh fish, organic coffee and cocoa, fresh fruit and vegetables, dairy, cassava, furniture, biofuels, wine, and cotton for garments. A fairly diverse picture emerges as there are quite different upgrading (and even downgrading or re-grading) strategies at work. The observed progress is also highly uneven.

What is most important are changes in the character of the value chain, especially whether it is buyer-driven or producer-driven, whether or not it is governed by a clear group of lead firms and whether African suppliers have an important role as lead firms or first-tier suppliers.

Case studies show that agribusiness value chains are increasingly buyer-driven and have a clear group of lead firms although not African ones (which is the case for citrus, clothing, fresh vegetables, coffee and cocoa), while there is no clear group of lead firms in cotton (Gibbon and Ponte 2005).

Recent demand changes in the global economy and in the African region – from consumers in the North to consumers in the emerging economies of the South – may lead to value chain restructuring from "upgrading" towards "re-grading" or even "downgrading" (Ponte 2011, pp. 132-133). Available STI capacity of Africa may be more suitable for these new markets.

Further agribusiness value chain analyses refer to characteristics of clusters and to innovation systems in clusters (Oyelaran-Oyeyinka and McCormick, eds., 2007). Specific innovation problems in clusters add to innovation problems in specific value chains. Innovation capacity is affected by the type of cluster and the specific value chain. Another study presents evidence on the knowledge and technology base of clusters with reference to specific value chains (Zeng 2008).

Key messages are similar to the prescriptions of the Rwanda case: recommended measures include encouraging further knowledge acquisition, adaptation, and dissemination; strengthening educational institutions and technology institutes and linking them better with businesses in clusters; enforcing clear regulations, standards and quality assurance mechanisms; and upgrading skills training (Zeng 2008). Further analyses of agribusiness value chains can be found in a survey of agro-industry and agribusiness of eight African countries (UNIDO 2011); in the context of country case studies it is shown that there is a widespread neglect of developing STI infrastructure and building human skills capacities.

What are the main messages for strengthening STI capacity in agribusiness value chains? Eight major lessons emerge from reviewing numerous agribusiness value chain case studies (Wohlmuth 2011), revealing eight determinants of value chain innovation capacity:

- Demanding markets drive innovation;
- Standards (for quality and measurement) and regulations (for labor, health, environment and safety) involve producers in innovation platforms;
- Dialogue forums between public and private actors and Public-Private partnerships promote investment in technological upgrading;

- Innovative financing mechanisms facilitate integration of value chains and technological upgrading;
- Associations of producers, traders and processors are central in lobbying for the key public goods and services provision needed for value chain upgrading;
- Access to knowledge institutions is important at all levels and ranks of the value chain to increase competitiveness;
- Chain-wide profitability is crucial for financing innovations and technological upgrading, increasing value addition in the value chain and integrating the value chains from raw materials supply to processing and marketing;
- Coordinating institutions for the management of the value chains are important for directing change and strengthening the overall innovation capacity.

These eight criteria form the selection criteria for the strategic support of agribusiness value chains (Wohlmuth 2011, pp. 183-186). Examples of agribusiness value chains for Nigeria show the relevance of these eight criteria for overcoming failure and ultimately achieving success (see Box 4).

Box 4: Impediments to the development of innovation capacity: The example of the value chains for fruits and palm oil in Nigeria

For Nigeria an analysis has been made of ten agribusiness value chains (cassava, cotton, fisheries, maize, fruits, palm oil, poultry, rice, soybeans, and tomatoes). Poor government policies, lack of leadership in value chains, gaps in infrastructure, and severe limits of innovative financing mechanisms impede technological upgrading in all these value chains (UNIDO 2010).

The two Nigerian value chains for fruits and palm oil are examples which show the implications of most or all of these eight criteria not being met (see UNIDO 2010, pp. 43ff. for fruits, and UNIDO 2010, pp. 48ff. for palm oil).

Despite a huge potential for fruits, there are extremely high post-harvest losses so that most of the fruit concentrate has to be imported for the processing of fruit juice. An import ban on fruit juice in 2002 merely led to the processing of imported fruit concentrate. All eight determinants of innovation capacity for agribusiness value chains are obviously not met.

Similar results are found for the palm oil value chain. Until the 1960s Nigeria was the largest producer of palm oil in the world. Output declined to 1.7 per cent of total world production, which is not even sufficient for local consumption (UNIDO 2010, p. 48). Because of the poor quality of the raw produce, local multinational companies in the food industry import palm oil rather than relying on local production (UNIDO 2010, p. 51). None of the eight criteria are met in the sector. Taking only these two value chains as examples, it can be seen that the innovation potential is not exploited at all.

It is also argued that palm oil production could take place in Nigeria in a sustainable way, and with considerable employment generation and poverty alleviation effects (Ayodele 2010). As poverty is a cause of forest clearing, this could also have a positive environmental effect.

Sources: Ayodele, T., 2010, African Case Study: Palm Oil and Economic Development in Nigeria and Ghana; Recommendations for the World Bank's 2010 Palm Oil Strategy, Lagos, Nigeria: Initiative for Public Policy Analysis, August 2010; UNIDO (2010) in cooperation with Central Bank of Nigeria (CBN) and Bank of Industry (BOI), Unleashing agricultural development in Nigeria through value chain financing, Final Report November 2010, Vienna: UNIDO. Author: KW.

For industry policy considerations, much more than relying on a central industrial policy is needed. Value Chain Participant Councils (VCPCs) are proposed (see Staatz 2011, pp. 83-86); these forms of organization could be the basis for a new industrial policy that is value-chain specific, end-market oriented and time-bound (Ponte 2011, pp. 133-134).

VCPCs can include participants from all levels and ranks of the value chain and may encourage the participation of all associations and groups of producers which supply inputs towards the end product.

The VCPCs are delivering valuable inputs to a central industrial policy; relevant information from below (bottom-up) and from the center (top-down) is provided and merged to form the

basis of a more relevant and coherent industrial policy.

Action level three: Converting comparative advantages into competitive advantages by using specific STI inputs

Export successes in agribusiness do not simply follow from the liberalization of markets and privatization of agribusiness companies. Much more is needed as the case studies for Latin America (Chile) and Asia (Malaysia) reveal (see Kjöllerström and Dallto, 2007; Wohlmuth 2011). The examples of fruits, wine, and salmon exports from Chile and of palm oil and derived products exported from Malaysia, provide evidence of the working conditions and the success criteria for converting comparative advantages of countries and regions into competitive positions of firms and farms.

Numerous other examples from Asia and Latin America could also be cited, but it is difficult to find such success stories in Africa, especially in its sub-Saharan region. Recent comparative evidence from the palm oil sectors in Malaysia and Ghana (Fold and Whitfield 2012) offers further insights into the process of how the conversion of comparative advantages into competitive positions works in Malaysia, but does not work in Ghana.

There are six critical factors for this conversion to materialize (Wohlmuth 2011, pp. 170-178): First, creating the infrastructural and legal preconditions for sustainable export successes is needed. Second, designing and implementing comprehensive long-term strategies is important. Third, organizing targeted public transfers to specific groups of private sector producers (not outright subsidies!) is relevant. Fourth, coordinating and upgrading global market activity by coherent public and private action is required. Fifth, providing for sustained large-scale actions over a long period, as well as ensuring the concentration of effort, is a must. Sixth, creating appropriate innovation platforms by linking producers and public and private research institutions is a key to success.

Comparing the palm oil sectors in Ghana and Malaysia reveals the differences with regard to converting comparative advantages into competitive advantages (see Box below). It is assumed that palm oil can be produced in Ghana and Malaysia in a sustainable way when properly regulated. It is reported by the Malaysian Palm Oil Council (MPOC) that Malaysia "is committed to sustainability, minimizing carbon-dioxide emissions and adopting agricultural practices that conserve the rainforests and wildlife" (MPOC 2008).

As such, Malaysia is presented as a model for other palm oil producing countries as the producers "have exhibited a strong commitment to zero-burning replanting techniques, protecting species such as Orang-Utan, and the certification of palm oil from established, licensed plantations" (MPOC 2008). In the case of Ghana, experts also hold the view that palm oil production is sustainable, if properly regulated, and that widespread poverty is the cause of deforestation and not the clearing of forests for plantations of palm trees (Ayodele 2010).

Box 5: Critical factors for the conversion of comparative advantages into competitive positions: A comparison of the palm oil sectors in Ghana and Malaysia

(1) Creating the infrastructural and legal preconditions for sustainable export successes does not only require working on providing the physical infrastructure, but also on the science, technology and innovation (STI) infrastructure and institutions to directly support export activity. This was an important success factor in Malaysia. In the case of Ghana, deficient infrastructure and an uncommitted state policy, but also inappropriate legal institutions to deal with land issues are still the major problems.

(2) Designing and implementing comprehensive long-term strategies was exercised in Malaysia but not in Ghana. Neither long-term STI strategies were developed nor were dialogue forums created to link public and private players in the devel-

opment of the sector in Ghana. Long-term strategies to develop new and derived products based on palm oil, as previously done in Malaysia, did not come about in Ghana.

(3) To organize targeted public transfers to specific groups of private sector producers (not outright subsidies!), specific support programs need to be targeted for large and medium-sized producers, processors and associations as well as for small and informal producers, processors and cooperatives. In Malaysia all this has worked, but in Ghana such programs did not materialize. The mixed systems of production in Ghana with plantations and out-grower schemes did not really work, leading to side-selling of raw materials by out-growers with negative effects on the planning and capacity utilization of processing units.

(4) To coordinate and upgrade global market activity by coherent public and private action, new export markets for improved traditional and/or new export products have to be identified continually. Export marketing councils have to research these markets systematically; such agencies are to be established jointly by private and public offices. Support from R&D, especially agricultural and industrial research institutions, is very important. All this takes place in Malaysia, but not in Ghana.

(5) Providing for sustained large-scale actions over a long period of time, as well as ensuring the concentration of effort, is a must. Success depends on scale of support and on concentration of effort, so that the critical minimum of funding and provision of support services is reached. Supporting large, medium-sized and small as well as informal producers over a long period and on a large scale is necessary. Again, this was achieved in Malaysia but not at all in Ghana.

(6) Creating appropriate innovation platforms by linking producers and public and private research institutions is a key to success. Upgrading quality, health, safety and environmental standards and intellectual property regulations to world class level worked in Malaysia but not in Ghana. In Malaysia, producers were forced to conform to such standards and regulations or even proceeded to develop local and regional standards and regulations themselves. By way of self-regulation among producers an innovation platform was created.

Source: Fold, N. and L. Whitfield (2012), Developing a palm oil sector: The experiences of Malaysia and Ghana compared, DIIS Working Paper 2012-08, Copenhagen: Danish Institute for International Studies/DIIS. Author: KW.

Case studies for Africa – African fish industry, especially in Tanzania, African horticulture business, especially in Kenya, Africa's pineapple industry, especially in Ghana and Côte d'Ivoire, coffee industry in Ethiopia, chocolate production in Ghana, leather industry in Ethiopia, traditional design-textile industry in Mali, and many other industry examples – show that none or only few of these six criteria are met in Africa, and that rare successes often rely on "do it alone" strategies of firms (Wohlmuth 2011, pp. 170-178; and case studies in UNIDO 2011).

Even in the Republic of South Africa – although much closer to meeting the six criteria and endowed with some successful international agribusiness – there are weak points along the value chains with regard to establishing new products on the market. South Africa is an exclusive world producer of Rooibos and Honeybush teas, but only a small share of the produce is so far packaged in South Africa (UNIDO 2011, Case Study South Africa, p. 391).

Those involved in promising agribusiness export activity in Africa – associations of firms, groups of firms, firms in clusters, but also cooperatives of smallholders and other associations of farmers – need more cooperation. Dialogue forums between public and private actors with an interest in promoting new export products are essential, but also informal exchanges between producers and the research community play a significant role.

A Strategy for Africa requires that pro-active policies are pursued at all three action levels, by working together with new business players and by cooperating better with the local STI infrastructure. Such a strategy can be applied to the agribusiness subsector level, the value chain level and the export-oriented product and producer levels. Public and private players in Africa can learn a lot from Asia and Latin America about how to manage change. The good news is that the ingredients of success are known and just have to be applied.

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Statistical Annex

Table 1: Production of sheanuts (karité) in West African countries, 1990-2010

	Area harvested (ha)			Yield (kg/ha)			Production (tons)		
Country	**1990**	**2000**	**2010**	**1990**	**2000**	**2010**	**1990**	**2000**	**2010**
Togo	2,500	2,075	3,200	2,558	4,096	***4,406***	6,396	8,500	14,100
Mali	44,624	74,752	75,500	22,400	2,137	***2,645***	99,944	159,776	199,700
Ghana	21,000	22,000	29,500	2,476	2,955	***2,420***	52,000	65,000	71,400
Benin	3,533	9,526	7,000	1,981	1,718	***1,829***	7,000	16,369	12,800
Côte d'Ivoire	9,000	17,494	21,000	2,283	1,765	***1,429***	20,551	30,874	30,000
Burkina Faso	35,000	30,373	37,800	2,519	1,989	***1,267***	88,173	60,396	47,900
Nigeria	184,000	232,000	342,750	1,571	1,591	***950***	289,000	369,000	325,610

Source: FAOSTAT, 03/05/2012, http://faostat.fao.org

Table 2: Production of cashew nuts in selected West African and Asian countries, 1990-2010

	Area harvested (ha)			Yield (kg/ha)			Production (tons)		
Countries	**1990**	**2000**	**2010**	**1990**	**2000**	**2010**	**1990**	**2000**	**2010**
Nigeria	50,000	259,000	330,000	600	1,799	1,800	30,000	466,000	594,000
Togo	650	254	500	903	1,260	1,580	587	320	790
Guinea	3,000	1,500	1,800	672	900	700	2,017	1,350	1,260
Burkina Faso	5,000	8,590	9,100	215	435	528	1,074	3,732	4,800
Ghana	1,000	12,418	59,000	480	620	481	480	7,697	28,400
Côte d'Ivoire	30,000	175,966	860,000	217	360	430	6,500	63,380	370,000
Guinea-Bissau	80,000	210,000	240,500	375	346	379	30,000	72,725	91,100
Senegal	3,000	25,000	16,200	167	280	352	500	7,000	5,700
Mali	---	4,000	9,000	---	400	322	---	1,600	2,900
Benin	20,000	185,000	243,900	150	216	286	3,000	40,000	69,700
Vietnam	*140,000*	*146,000*	*339,000*	*1,000*	*1,855*	*3,659*	*140,000*	*270,400*	*1,242,000*
India	*531,000*	*686,000*	*923,000*	*538*	*758*	*664*	*285,590*	*520,000*	*613,000*

Source: FAOSTAT, 03/05/2012, http://faostat.fao.org

Table 3: Producer prices in US-Dollar, various products, West African countries, 1991-2009

	Cashew nuts with shell in USD / ton			Sheanuts in USD / ton			Mango in USD / ton		
Countries	**1991**	**2000**	**2009**	**1991**	**2000**	**2009**	**1991**	**2000**	**2009**
Burkina Faso	n.a.	n.a.	n.a.	106.3	87.3	109.6	177.2	34.9	171.2
Côte d'Ivoire	647.0	491.5	169.2	202.0	62.6	800.7	353.2	276.3	294.0
Ghana	909.6	320.8	496.6	96.8	190.5	206.7	40.8	100.4	163.1
Mali	n.a.	n.a.	n.a.	299.7	92.8	193.4	225.8	156.2	200.6
Togo	n.a.	n.a.	n.a.	124.1	103.3	222.8	n.a.	n.a.	n.a.

Source: FAOSTAT, 03/05/2012, http://faostat.fao.org

Table 4: Exports of processed and unprocessed cashew from West African countries, (including intra-West African transit trade), 2010

	Unprocessed export value in US$,000	Unprocessed export weight in tons	Share of unprocessed export in production	Processed export value in US$,000	Processed export weight in tons	Unprocessed export value US$ / ton	Processed export value US$ / ton	Processed to unprocessed exports (weight)
Benin	22,976	57,704	83 %	630	939	$398	$671	1.6 %
Burkina Faso	7,060	18,532	386 %	673	412	$381	$1,633	2.2 %
Côte d'Ivoire	310,928	349,949	95 %	4,993	1,158	$888	$4,312	0.3 %
Gambia	3,336	21,061	n.a.	0	0	$158	---	0.0 %
Ghana	13,354	32,043	113 %	916	1,471	$417	$623	4.6 %
Mali	920	4,863	168 %	67	220	$189	$305	4.5 %
Nigeria	142,674	85,669	14 %	71,780	16,899	$1,665	$4,248	19.7 %
West Africa	**501,248**	**569,821**	**29 %**	**79,059**	**21,099**	**---**	**---**	**3.7 %**

Source: computed from FAOSTAT, 03/05/2012, http://faostat.fao.org and UN comtrade, 03/05/2012, HS 080131 + HS 080132

Table 5: Production of mangoes, mangosteens, and guavas in West African countries, 1990-2010

	Area harvested (ha)			Yield (kg/ha)			Production (tons)		
Countries	**1990**	**2000**	**2010**	**1990**	**2000**	**2010**	**1990**	**2000**	**2010**
Cape Verde	100	217	160	47,610	21,823	***40,625***	4,761	4,737	6,500
Mali	1,574	2,380	25,100	9,063	10,885	***18,757***	14,265	25,905	470,800
Ghana	500	945	700	8,000	4,233	***10,000***	4,000	4,000	7,000
Nigeria	85,000	125,000	114,900	5,929	5,840	***6,877***	504,000	730,000	790,200
Senegal	9,000	10,500	14,900	6,222	6,952	***6,711***	56,000	73,000	100,000
Guinea-Biss.	600	1,173	900	6,167	4,845	***6,444***	3,700	5,683	5,800
Burkina Faso	1,049	2,034	1,700	4,766	3,095	***6,118***	5,000	6,296	10,400
Niger	---	4,000	35,000	---	5,000	***5,000***	---	20,000	175,000
Gambia	55	182	270	4,546	3,456	***4,444***	250	629	1,200
Benin	2,414	4,681	3,300	5,065	3,290	***4,152***	12,227	15,398	13,700
Guinea	25,000	52,936	76,900	2,000	1,493	***2,131***	50,000	79,055	163,900
Sierra Leone	1,910	4,216	4,800	2,618	1,469	***1,542***	5,000	6,191	7,400
Côte d'Ivoire	20,000	50,331	84,000	470	470	***506***	9,400	23,655	42,500

Source: FAOSTAT, 03/05/2012, http://faostat.fao.org

Compiler of Statistical Annex: Hans H. Bass